****

NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

NASA-13852 (SEPTEMBER 1999)
NASA - KSC
SUPERSEDING NASA-13852
(MARCH 1999)

****

SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13852

PREACTION CONTROL SYSTEMS

09/99

-- End of Section Table of Contents --

****

NASA-13852 (SEPTEMBER 1999)
NASA - KSC
SUPERSEDING NASA-13852
(MARCH 1999)

NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION

****

SECTION 13852

PREACTION CONTROL SYSTEMS
09/99

****

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers fire-alarm and detection equipment. Drawings should indicate the location and mounting height of manual alarm stations; automatic fire detectors; bells including the trouble bell (when not contained in the control unit) and the control unit; boundaries and classifications of hazardous locations; system programming information for microprocessor based systems; the number of alarm-initiating and indicating circuits reporting to or supervised by the control unit; a riser diagram of the fire-alarm system including interlocking circuits to air-handling-unit and ventilating-fan controllers; and interfaces with fire-protection systems and central fire monitoring stations.

Point-to-point wiring is defined as wiring from field device with integral terminal strip to next device with integral terminal strip, wiring between modules internal to fire alarm control panels, circuit terminations on terminal strips in fire alarm control panels, terminal boxes.

Add to Section 01000, "Scope and Description," a description of the scope of the fire alarm work particular to this project.

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: The following references should not be

manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

****

The publications listed below form a part of this section to the extent referenced:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(1997) Code for Safety to Life from Fire in Buildings and Structures
NFPA 70	(1999) National Electrical Code
NFPA 72	(1996) National Fire Alarm Code
NFPA 90A	(1996) Standard for the Installation of Air Conditioning Ventilating Systems

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET PDM	(1989; 2nd Ed) Program Detail Manual

UNDERWRITERS LABORATORIES (UL)

UL 464	(1996; 7th Ed) UL Standard for Safety Audible Signal Appliances
UL 497B	(1993; 2nd Ed) UL Standard for Safety Protectors for Data Communications and Fire Alarm Circuits

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01330, "Submittals," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

****

The following shall be submitted in accordance with Section 01330, "Submittals," in sufficient detail to show full compliance with the specification.

SD-01 Preconstruction Submittals

Evidence of the Contractor's State Certification shall be submitted to the Contracting Officer for approval prior to any work being started on the Preaction Control System.

Fully verified and dated copies of all test data and results shall be submitted with a copy of the approved test procedure and any factory test information.

Contractor will provide one copy of the test procedure and recording forms for the preliminary tests. For the final acceptance tests, the Contractor will provide 10 copies of the test procedures and recording forms.

SD-02 Shop Drawings

The following shall be submitted for preaction control systems in accordance with the paragraph entitled, "General Requirements."

Connection Drawings
Schematics

As-Built drawings shall be submitted for approval 14 days prior to the acceptance testing phase of the project as described in the paragraph entitled "Field Testing" of this specification. Two (2) sets of magnetic media and hard copies of all new and revised software and drawings shall be provided with the submittal. As-Built drawings shall document final system configuration including deviations from and amendments to the drawings, and field installation changes, concealed and visible.

DWG or DFX Format computer generated floor plan layouts indicating all control panel and device locations shall be provided.

Fire Service Floor Plan shall indicate location of the preaction control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, air sampling smoke detectors, preaction sprinkler riser, smoke fire dampers, magnetic door holders and all other equipment associated with the preaction system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used). Provide a symbol legend which clearly identifies each device shown on the Fire Service Floor Plan. There shall be no borders or title blocks on the Fire Service Floor Plan. Install a copy of the Fire Service Floor Plan minimum size (18 inches by 24 inches)in a painted metal frame with a plexiglass cover. The floor plan and it's location shall be submitted for approval to the Contracting Officer prior to installation.

SD-03 Product Data

Manufacturer's catalog data shall be submitted for the following items:

Preaction Control Panel
Central Fire Monitoring System
Addressable Modules/Devices
Alarm Bells
Strobe Units
Speakers
Water Flow Alarm Devices
Valve Tamper Switches
Remote Auxiliary Control Relays
Power Source

SD-05 Design Data

List of Parts and Components shall be sumitted in accordance with the paragraph entitled, "System Requirements," of this section.

Design analysis and calculations shall be submitted for Preaction Control System consisting of the battery capacity and loading calculations in accordance with the paragraph entitled, "Preaction Control Panel" are met.

****
NOTE: Coordinate these submittals with Contract Schedule Section IV, "Inspection Testing Requirements."
****

SD-07 Certificates

Quality Assurance Plan shall be submitted consisting of the following:

Contractor shall prepare a test procedure and test record forms for conducting and recording complete tests on the preaction control panel, reporting system, wiring system(s), and field devices installed in accordance with the manufacturer's requirements and these specifications. Contractor shall submit for approval the test procedure to the Contracting Officer at least 30 days prior to the preliminary system test described in the paragraph entitled "Field Testing" of this specification section. Test procedure shall identify each device and circuit to be tested, describe the initial condition, each step or function in the test, required test results, and equipment to be employed. Test forms with suitable spaces shall be provided for recording test results on all equipment, devices, and wiring to be tested. Test record forms shall also have identified spaces for verification signatures of official witnesses and dates of the test.

Contractor shall submit proof that all components are Underwriter Laboratory (UL) listed or Factory Mutual (FM) approved for their intended use and function.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with the paragraph entitled, "Installation," of this section.

1.3 GENERAL REQUIREMENTS

****

NOTE: Section 16003, "General Electrical Provisions," must be included in the project specifications when this section is used.

****

Section 16003, "General Electrical Provisions," applies to work specified in this section.

Connection drawings shall be submitted for approval for Preaction Control Systems. Connection drawings shall consist of point-to-point wiring diagrams of internal and external wiring to include the existing Simplex Model 4100 and the new preaction control panel Simplex Model 4020 or approved equal including, but not limited to, all fire alarm field devices, and panel wiring. Point-to-point wiring is defined as wiring from field device with integral terminal strip to next device with integral terminal strip, wiring between modules internal to the preaction control panel, circuit terminations on terminal strips inside the preaction control panel, terminal boxes, etc.

DWG or DFX Format computer generated connection drawings shall be submitted.

Schematics shall be submitted for approval for Preaction Control Systems consisting of the following:

Module schematic drawings (minimum size 11 by 17 inches 280 by 430 millimeter) to be provided prior to system acceptance testing.

Revised program information (CMS file), both hardcopy and disks, for existing Simplex Model 2120 Central Fire Monitoring System, existing Simplex Model 4100 and the new Preaction Control panel Model 4020 or approved equal. Program information for preaction control panel including program listing, system point summary, and addressable device switch settings.

Program logic and/or ladder diagrams which show interaction of system components.

1.4 SYSTEM REQUIREMENTS

Preaction Control system shall be a microprocessor based addressable Simplex 4020 or equal networked to the existing Simplex 4100 facility fire alarm control panel, supervised, non-coded electrical alarm system with NFPA 72 Style D initiating device circuits NFPA 72 Style Z notification appliance circuits and NFPA 72 Style 7 signaling line circuits. System shall be electrically connected to report alarms to the remote reporting system; sound the general alarm continuously; and control auxiliary equipment such as smoke fire dampers, air handling units, magnetic door

latches, etc., upon operation of one or more initiating devices. Initiating, signal, and auxiliary control circuits shall be 24 Vdc.

System shall conform to all the applicable requirements of NFPA 70, NFPA 72, NFPA 90A, and NFPA 101.

Preaction Control system shall contain all of the equipment, devices, programming and circuits required for system operation in accordance with NFPA Codes and KSC requirements, including remote reporting to and remote control from existing Simplex 2120 based Central Fire Monitoring System (CFMS) equipment.

Contractor shall provide all additional equipment, cabinets, conduit, and labor to meet the requirements and intent of this specification.

List of parts and components for the installed system by manufacturer's name, part number, and nomenclature, and recommended stock level required for normal maintenance and unscheduled repairs.

1.5 QUALITY ASSURANCE

Equipment to be provided under this specification shall be that manufactured fire-alarm equipment which meets the requirements of the section entitled, "System Requirements." It shall be the latest standard design, and shall be listed by Underwriters' Laboratories or approved by Factory Mutual and is suitable for the intended services. All devices installed will function with the control panel and not interfere with the operation of the control panel.

****

NOTE: Delete the following paragraphs if a Simplex series panel is being Sole-Sourced.

****

Where the phrase "or equal" is used with reference to Simplex Time Recorder Company equipment, the alternate equipment must be a functional equivalent. Equivalent equipment must communicate with the existing Simplex Model 2120 Central Fire Monitoring System in exactly the same manner as Simplex equipment; must be approved by a recognized testing laboratory such as UL or Factory Mutual; and must meet KSC requirements for reporting and control equipment.

1.6 SERVICES OF A CERTIFIED FIRE ALARM SPECIALIST

Services of a Certified Specialist thoroughly experienced in fire detection and alarm work shall be provided on site to perform or directly supervise the installation, make all necessary adjustments and perform all tests on the preaction control system at the site.

Fire Alarm specialist shall be considered certified when the specialist holds a valid Fire Alarm System, Level III Certification from the National Institute for Certification in Engineering Technologies is licensed by the State of Florida as a Fire Alarm Contractor I in accordance with Florida State Statute, Chapter 489, Part II.

Evidence of the Contractor's State Certification shall be submitted.

Certification of other recognized agencies with equivalent requirements will be considered. Evidence of the equivalent certification and the basis of certification shall be provided to the Contracting Officer and be approved by the Contracting Officer prior to any work being performed at Kennedy Space Center. Contractor submitted certification requirements shall be in accordance with NICET PDM.

PART 2 PRODUCTS

2.1 PREACTION CONTROL PANEL

Preaction control panel (PCP) shall contain power-on, fire, supervision, and trouble indicating lights plainly visible when the cabinet is closed. It shall also contain the following switches accessible only by unlocking and opening the unit:

Alarm Silence
Trouble Silence
Power On-Off (If standard by the manufacturer)
Alarm/Trouble Reset
Auxiliary Devices (AHU shutdown relay) Maintenance Bypass Switch

Preaction control panel shall contain all components necessary to monitor and supervise all detection circuits. When any air sampling detection zone, water flow switch, etc. connected to the preaction control panel is activated, the preaction control panels alarm indicators and alarm-control circuits shall be activated. This shall activate the external audio visual notification appliances and auxiliary control devices indicated; provide zone indication(s); and send an alarm signal to the remote Central Fire Monitoring System. Notification appliance circuits shall have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity.

Preaction control panel shall contain all components necessary to monitor and supervise all supervisory device circuits. When any valve tamper switch, pressure switch, air sampling detection system(s), or other supervisory device connected to the control panel is activated, the control panel trouble or supervisory visual indication and audible signal devices shall be activated; zone indication(s) shall be provided; and a supervisory signal shall be sent to the remote Central Fire Monitoring System.

Preaction control panel shall contain all components necessary to operate and supervise the circuits for annunciator panels indicated and auxiliary devices controlling equipment such as air handling units, fan coil units, smoke fire damper motor(s), preaction solenoid valve(s), magnetic door holders, etc. Circuits for auxiliary control relays shall be supervised to within 3-feet 910 millimeter of the device to be controlled in accordance with NFPA 101. Preaction control panel shall include a maintenance bypass switch for all auxiliary control devices. Bypass switch shall be supervised to report trouble when in the maintenance position.

Control panel shall monitor and report as trouble, open supervised circuits, ground faulted supervised circuits, removal of detector or device, removal or failure of control panel module, maintenance bypass switch activated, loss of primary power, power supply trouble, low battery voltage, loss of battery voltage, preaction control panel enclosure open, and activation of the alarm silence switch. All trouble signals shall be identified by monitor, signal, or auxiliary control circuit (zone indication). Trouble signals shall activate the control panel trouble visual indication and audible signal devices, and send a trouble signal to the remote Central Fire Monitoring System.

Alarm/trouble reset switch shall reset a cleared detector system in alarm or trouble. Alarm or trouble signals shall not be self-restoring without activating the switch.

Alarm and trouble silence switches shall silence the alarm and trouble audibles. Either switch placed in other than the normal position shall provide the following:

a. Report as a trouble to the Central Fire Monitoring System.

b. Transfer audible signal to a panel lamp visual indication.

c. Re-ring the trouble audible if the problem has been cleared, but the switch has been left in the silence position.

When the alarm silencing switch is in the silence position, subsequent alarms in other zones shall operate the alarm-sounding devices.

Preaction control panel shall be UL listed or FM approved for use with the air sampling detection system, releasing of preaction suppression system solenoid valve(s) and all other fire alarm devices specified in this section.

Preaction control panel shall have a normally closed dry single pole, double throw (SPDT) contact which opens for trouble conditions and a normally dry single pole, double throw (SPDT) contact which closes under alarm conditions for use on remote reporting circuits.

All relays shall be continuous duty and have self-cleaning contacts of silver or an alloy of equivalent performance. Supervisory relays shall be suitably protected against dust by individual covers. All relays that provide zone and external functions, such as remote reporting, control device activation, and signal lights, and shall have at least one set of spare contacts. Relays shall be permanently marked with the coil resistance, operating-current range, and internal pin connections using standard pin numbers.

Preaction control panel, terminal cabinets and battery cabinets (when used) shall be steel, provided with a hinged cover and an integral pin-tumbler cylinder lock (Lock Cylinder No. Best Universal Lock Co. No. A8817-XUS26D-7KSC) with removable core that will accept the key presently in use with other control units existing in the area; lock core will be

provided by the government. Cabinets shall be painted with a prime coat and one or more finish coats of scratch-resistant baked enamel. Finish coat shall be red unless otherwise indicated. An etched metal or engraved laminated plastic identification plate labeled, "Preaction Control Cabinet," shall be permanently affixed to the cabinet door of the preaciton control unit to identify the cabinet as a preaction control system cabinet. For cabinets painted red the identification plate shall have white letters on a black background. For cabinets not painted red the identification plate shall have white letters on a red background.

System shall operate from a power supply with 120 grounded Vac input and 24 Vdc output. System shall operate satisfactorily with power input voltage varying from 85 to 110 percent of nominal value. Power supply output shall be capable of powering all initiation, signaling, annunciation, and control devices during alarm condition with 25 percent minimum spare capacity. If supplied within the cabinet, the power on-off switch shall disconnect all power sources to the control panel.

Batteries, charger, and power transfer equipment shall provide the means of automatically supplying the entire preaction control system with battery backup power in event of a primary power system failure. System shall switch to battery power in event of AC power failure and switch back to AC power upon return of primary power. Control panel shall be able to operate when the backup batteries are disconnected for any reason. System shall control charging currents and floating voltage levels to maintain batteries in optimum condition. Capability to recharge batteries in event of discharge shall be provided. Wiring shall be fused to protect against battery over-current and polarity reversal. Primary power, battery, or charging equipment failure shall result in a preaction control panel trouble signal and visual indication.

Battery modules shall be sealed (no corrosive fumes) and spill-proof. Batteries shall be listed for fire alarm service and shall be suitable for high discharge currents required under alarm conditions. Batteries shall be sized to operate the fire alarm and detection system in normal supervisory condition for 24 hours, minimum, then operate the system in the alarm mode for 15 minutes, minimum.

Provide a battery disconnect switch with dc rated contacts to permit testing for the loss of secondary power.

****

NOTE: Edit the following paragraph for a fire alarm control panel to be used in small facilities or suppression systems with 6 zones or less, and 1 CFMS reporting zone. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.

****

****

NOTE: Edit the following paragraph for a fire alarm control panel to be used in facilities with 32 zones or less, and 6 CFMS reporting zones or less. Fill

in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.

****

2.1.1 Simplex Fire Alarm Control Panel

****

NOTE: Select and edit the following paragraph for a Simplex 4002 fire alarm control panel to be used in a medium size facility of 6 to 32 zones. Initiation, indicating, and control circuits indicated are identified in KSC standard configuration drawing 81K03009.

****

Unit shall be a Simplex Model 4020 comprised of addressable channel that provides communications for up to 127 remote addressable devices (including TrueAlarm analog sensors) expandable to 254 addressable devices, 4 I/O circuits expandable to 20, field selectable in any combination to be either Style D initiating device circuits, or Style Z notification appliance circuits (rated at 2 Amps @ 24 Vdc), or auxiliary control circuits (Single pole double throw contacts rated at 2 Amps resistive @ 24 Vdc and 0.5 Amps inductive @ 120 Vac). Construction shall be modular, solid state microprocessor based electronics. All modules shall be equipped with transient suppression. System shall include nonvolatile programmable operating system memory for all operating requirements. Panel shall include modules required for communication interface with the existing Simplex 2120 based Central Fire Monitoring System, including Style 7 module(s) for operation of redundant remote reporting circuits. Communication interface shall permit individual remote reporting of all monitor zones and remote control of the preaction control panel outputs from the Central Fire Monitoring System.

****

NOTE: Select and edit the following paragraphs for a Simplex 4100 fire alarm control panel to be used in a large size facility or facility requiring addressable devices, audio, or fire fighters telephone. Basic panel configuration is KSC standard configuration drawing 81K03011 for systems without audio signaling capability, and drawing 81K03010 for systems with audio capability.

****

Preaction control panel shall include all components and modules required for installation of a multiple addressable device network. Network shall utilize polling methods and provide two-way Style 6 supervised communications between the preaction control panel and addressable monitor, signal, and control modules. System shall include network channel(s) capable of supporting a maximum of 254 addressable devices and 20 addressable I/O points.

****

NOTE: Edit this paragraph as required for systems of 6 CFMS reporting zones or less without Simplex Model 2120 compatible communications equipment.

A Simplex Model 4100 system is installed at the VABR and CD&SC for monitoring of small systems in the LC-39 or Industrial Area respectively.

****

****

NOTE: Edit these paragraphs as required for systems installed with Simplex 2120 communications interface equipment.

Simplex Model 2120 Central Fire Monitoring System transponders are installed in Room 1P11 of the Launch Control Center, the VABR, and the CD&SC.

KSC standard configuration drawings for modem cabinets match the Simplex control system used.

****

2.2 ADDRESSABLE MODULES/DEVICES

****

NOTE: Select and edit paragraphs as necessary for the multiplex system designs only.

****

Addressable modules shall be solid state compatible with the preaction control panel. Modules shall be suitable for individual outlet box mounting or group mounting within a control enclosure. Modules installed outdoors shall be installed in weatherproof enclosures with a neoprene gasket and shall be protected from corrosion.

Modules shall be field addressable to individually communicate with the preaction control panel using multiplexed communication techniques. Communication circuit wiring connections shall be suitable for supervised Style 6 operation. Module power shall be derived from the communication circuit or 24 Vdc power supply supervised by the preaction control panel. Invalid address setting, component failure, or power failure shall initiate a trouble signal at the preaction control panel.

Enclosures shall be painted with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Enclosures shall include an engraved phenolic nameplate labeled, "PREACTION MODULES."

Addressable modules for initiation circuits shall be supervised 4-wire Style D type unless otherwise indicated. Addressable modules for notification appliance circuits shall be supervised parallel wired Style Z type unless otherwise indicated. Module shall be suitable for use with bells, strobes, relays, and audio speakers. Addressable modules for control circuits shall include 2 separate fused Form-C contacts rated 2 Amperes at 28 Vdc or 0.5 Amperes at 120 Vac.

****
NOTE: Edit paragraphs as necessary for flame detection characteristics.
****

****
NOTE: Use the following paragraph where addressable smoke detectors are to be used.
****

****
NOTE: Use the following paragraph where air duct smoke detectors are require.
****

****
NOTE: Use the following paragraph only where smoke detectors are required and detectors compatible with the fire alarm control panel are not available.
****

****
NOTE: Use the following paragraph for modification to the VAB and LCC buildings only.
****

2.3 ALARM BELLS

Preaction bells shall be red, 10 inches 250 millimeter vibrating, under-dome, notification appliances in accordance with UL 464. Bell shall produce at least 87 dB at 10 feet 3000 millimeter and shall conform to NFPA 70.

Alarm bells shall be solenoid-operated plunger sounding devices. Operating mechanism shall be rustproof, protected from dust and insects, and located behind the gong shell.

Alarm bells shall operate from polarized 24 Vdc preaction control panel Style Z parallel wired supervised signaling circuit. Wiring connection shall be on terminal blocks suitable for No. 16 through No. 12 AWG 1.25 through 2 millimeter diameter (No. 16 through No. 12 AWG) solid copper conductors.

Strobe portion of combination audible/visual notification appliances shall be in accordance with the applicable provisions of the paragraph entitled, "Strobe Units."

Surface-mounted alarm bells installed in unfinished areas with conduit exposed shall be secured to surface-mounted back boxes. Back boxes shall be cast iron or cast aluminum, with threaded conduit connections. Alarm bells installed outdoors shall be weatherproof with a neoprene gasket and shall be protected against corrosion. All exposed metal surfaces shall be painted with a prime coat and one or more finish coats of red enamel to

provide a smooth, hard, durable finish.

2.4 STROBE UNITS

Strobe units shall meet the requirements of the Americans with Disabilities Act (ADA) and shall be constructed of red cast metal housing, clear polycarbonate dome lens with red "FIRE" lettering on two sides , and a zenon flash tube with solid state circuitry. Unit brightness shall be no less than 75 candela, producing approximately 80 to 90 flashes per minute. Unit shall be UL listed or FM approved for fire protective service.

Unit shall operate from polarized 24 Vdc preaction control panel Style Z parallel wired supervised notification appliance circuits. Operating current shall not exceed 0.1 amperes, and unit shall operate over a 20 percent variation in nominal input voltage. Wiring connection terminal blocks shall suitable for No. 16 through No. 12 AWG 1.25 through 2 millimeter diameter solid copper conductors.

Flush mounted interior units shall be installed using standard electrical backboxes. Surface mounted units shall be installed in cast iron or cast aluminum boxes with threaded conduit hubs. Units mounted in exterior or wet locations shall be weatherproof with a neoprene gasket and shall be protected from corrosion.

All metal exposed surfaces shall be painted with a prime coat and one or more finish coats of red enamel to provide a smooth, hard durable finish.

2.5 SPEAKERS

Notification appliance speakers shall be UL listed or FM approved for audible signal use, and shall be capable of clearly reproducing voice messages and bell tones over a 400 to 4000 Hz range. Speaker output at 1000 Hz for 1 Watt input power shall be no less than 87 dB at 10 feet 3000 millimeter.

Signaling mechanism shall consist of sealed speaker and multiple-tap impedance matching transformer suitable for 25 Vdc Style Z parallel wired supervised audio signaling systems. Transformer settings shall include 0.25, 0.5, 1.0, and 2.0 Watt taps unless others unless otherwise indicated. Wiring connections for 4 wire operation shall be screw terminals suitable for No. 16 through No. 12 AWG 1.25 through 2 millimeter diameter conductors.

Speakers housings shall be of red impact resistant polycarbonate or cast metal construction. Flush mounted interior speakers shall be mounted using standard electrical backboxes. Surface mounted speakers shall be mounted using red cast iron or cast aluminum boxes with threaded conduit hubs. Speakers mounted in exterior or wet locations shall be weather-proof with a neoprene gasket and shall be protected from corrosion. All metal exposed surfaces shall be painted with a prime coat and one or more finish coats of re-enamel to provide a smooth, hard, durable finish.

Strobe portion of combination audible/visual notification appliances shall be in accordance with the applicable provisions of the paragraph entitled, "Strobe Units."

2.6 WATER FLOW ALARM DEVICES

Water flow alarm devices shall conform to UL or FM requirements for the particular type of sprinkler system. Contacts shall have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 Vdc or 250 Vac.

[Pressure switches shall be wired to make or break initiating circuits depending on rise or fall of water or air pressure.]

2.7 VALVE TAMPER SWITCHES

Valve tamper switches shall conform to UL or FM requirements for use on the specified valve. Contacts shall have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 Vdc or 250 Vac.

2.8 REMOTE AUXILIARY CONTROL RELAYS

Remote control relays shall have continuous duty coils rated 24 Vdc. Where relays are used on Style Z parallel wired supervised circuits, coils shall incorporate supervisory current blocking diode. Relays shall have a minimum of two (2) single pole, double throw contacts rated 10 amps at 28 Vdc or 250 Vac. Where auxiliary control circuits connected to the relay are protected at a higher ampacity than the relay contacts are rated, fusing rated to protect the relay contacts shall be installed in the relay enclosure.

Remote auxiliary control relays shall be mounted in enclosures indicated or, if not indicated, in manufacturer's required enclosure. Relays installed outdoors shall be installed in a weatherproof enclosure with a neoprene gasket and shall be protected against corrosion.

Enclosure shall be painted with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Enclosure shall be labeled with an engraved phenolic nameplate labeled, "F/A RELAY."

Remote auxiliary control relays must be mounted and supervised within 3 feet 910 millimeter of the controlled device in accordance with NFPA 101.

2.9 POWER SOURCE

Normal power to the local systems for all purposes, including separate powered indicating/alarm devices, shall be 120 volts 60 hertz. System shall operate satisfactorily between 85 and 110 percent of normal voltage. Preaction system disconnect/protective device shall be a fused switch with a red factory finish as specified herein for manual alarm stations. This disconnect switch shall be mounted adjacent to the fire alarm control panel. In addition, it shall be marked PREACTION CONTROL PANEL DISCONNECT with 1/2-inch 12 millimeter high letters in white paint or engraved phenolic identification plates fastened with sheetmetal screws. Switch shall be capable of being locked in the "on" or "off" position. This feature shall not interfere with the circuit protection capability of the device. Switch shall be equipped with surge suppression for all phase and neutral conductors. Current limiting Class RK1 fuses properly sized to

protect the preaction control panel components shall be installed.

PART 3 EXECUTION

3.1 SYSTEM SEQUENCE OF OPERATION

3.1.1 Normal Operation

All switches shall be in the normal position. Available power lamp shall be on and the trouble and detector identification lamps shall be off. All circuits shall be electrically supervised.

3.1.2 Trouble Condition

System conditions identified in the paragraph entitled, "Preaction Control Panel," shall transmit a trouble signal to the remote reporting device of the Central Fire Monitoring System, provide zone indication, activate a trouble signal in the preaction control panel, and provide input to remote annunciators (when used). Trouble signal in the alarm-control unit shall be comprised of visual and audible indications.

3.1.3 Alarm Condition

Activation of any detectors, manual alarm stations, water flow switches, or other initiating devices shall close a contact that activates the appropriate preaction control panel. Preaction control panel transmits a signal to the remote reporting device of the Central Fire Monitor System; activates the notification appliances; provides zone identification; controls air handling and ventilating units; provides an input to remote annunciators (when used); and provides indication or control to devices or other systems.

3.2 INSTALLATION

Operation and Maintenance Manuals shall be submitted. Information bound in manual format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions. This information shall be submitted prior to acceptance tests being performed.

3.2.1 Preaction Control Panel(s) and Reporting Equipment

Equipment shall be installed in each protected building, located where indicated, and shall be complete with all indicated accessories and devices. Equipment shall be installed in accessible locations in such a manner as to prevent damage from vibration or jarring. Equipment requires a minimum of 3 feet 910 millimeter clearance directly in front of the panel for maintenance per NFPA 70. With multiple equipment, the 3 foot 910 millimeter clearance is required directly in front of the complete configuration. In addition, a 28 inch 710 millimeter clear aisle way will be provided for access to the equipment.

Wiring within preaction control panel(s) and reporting equipment shall be installed in accordance with the paragraph entitled, "Installation in

Cabinets and Boxes."

When preaction control panels and reporting equipment are installed flush or semi-flush, three spare 1-inch 25 millimeter conduits in accordance with the paragraph entitled, "Conduit and Raceways," shall be installed from the preaction control panel wiring termination cabinet to an accessible location.

3.2.2 Addressable Modules and/or Devices

Zone addressable modules shall be installed at accessible locations indicated. Module address switches shall be configured to settings indicated on approved shop submittals. Modules shall be identified individually adjacent to their mounting.

Control zone addressable modules used for smoke control, AHU shutdown, etc. shall be mounted in accessible locations within 3-feet 910 millimeter of the device to be controlled. Control modules connected to separately energized control wiring from auxiliary systems shall not be installed in the same enclosure with initiation and signal zone addressable modules.

Where zone addressable modules are grouped within an enclosure, wiring shall be in accordance with the paragraph entitled, "Installation in Cabinets and Boxes."

3.2.3 Alarm Bells/Speakers

Bells and/or audio speaker notification appliances shall be mounted at the approximate locations indicated. Mounting height shall be 90-inches 2290 millimeter above the finished floor measured from the top of the bell/speaker, but no less than 6-inches 150 millimeter below the ceiling.

3.2.4 Strobe Units/Combination Audio Visual

Strobe light signaling units shall be mounted at the approximate locations indicated. Locations shall be unobstructed and allow viewing by area occupants in accordance with NFPA 70. Mounting height shall be 80-inches 2030 millimeter above the finished floor measured from the bottom of the strobe, but no less than 6-inches 150 millimeter below the ceiling.

3.2.5 Auxiliary Control Relays

Remote control relays shall be installed and supervised in accessible locations within 3-feet 910 millimeter of the device to be controlled.

3.2.6 Wiring

Wiring shall conform to the requirements of NFPA 70 and the following special requirements:

Preaction system circuits shall be installed in a separate raceway system. Within the preaction system, 60-hertz power circuits and initiating, notification and control circuits shall be installed in separate raceway systems. 60-Hertz power circuits shall not enter

enclosures containing preaction circuits except where required to connect to the preaction control system.

Conductors shall be continuous from a terminal point at one device to a terminal point at the next device and from a device to the preaction control panel. Break wires at each terminal; wires shall not be looped over a terminal. Approved explosion proof devices provided with pigtail wiring connection leads shall be terminated on a field installed terminal strip installed in the box on which the device is mounted. Solderless ring tongue terminal lugs shall be installed with manufacturer's required tooling on the device wiring connection leads. This ring type lug will be used on stranded wire only. Termination of solid wire will be made on compression or screw type terminals. When screw type terminals are used the conductor must be captured under 80 percent of the screw head surface.

[Surge suppression in accordance with UL 497B shall be installed on each conductor of preaction control system circuits which extend beyond a building. Protection shall be located as close as practical to the point where the circuits leave the building. Protectors shall be installed in enclosures of adequate size with terminal strips for all wiring connections plus 25 percent spare. Enclosures shall be painted with a prime coat and one or more coats of red baked enamel finish to provide a smooth, hard, and durable finish. Protectors shall be connected to a earth ground electrode system in accordance with the manufacturer's requirements and NFPA 70.]

Conductors installed on the preaction system shall be solid copper with an insulation rating of not less than 300 volts. Conductors shall be marked with the size, voltage rating and manufacturer's name permanently marked on the conductor jacket at no less than two feet 610 millimeter intervals. Conductor size and color are listed below. Where modifications are made to existing systems, the new or added conductors shall match the size and color coding of the existing system.

Conductors for multiplexed communication circuits, speaker audio circuits, and remote station signaling circuits shall be solid copper, shielded, twisted pairs. Cable shall be listed as type FPL, Power-Limited Fire Protective Signaling Cable. Conductor size installations shall be as indicated but not less than No. 18 AWG 1 millimeter diameter. for initiation circuits and No. 16 AWG 1.25 millimeter diameter for signaling circuits. Cables shall be marked with circuit designation and consistent color coding for the positive and negative loops shall be maintained throughout the cable system.

Direct current initiating (air sampling smoke detector) circuits shall be a two loop circuit per NFPA 72, Style D with the positive loop conductor colored blue and the negative loop conductor colored black. Conductors size shall be as indicated, but not less than No. 16 AWG 1.25 millimeter diameter. Conductor insulation shall be type TFN for No. 16 AWG 1.25 millimeter diameter and type THHN/THWN for No. 14 AWG 1.6 millimeter diameter and larger.

Direct current notification appliance circuits shall be parallel wired

per NFPA 72, Style Z. Positive conductor shall be colored red and the negative conductor shall be colored orange. Conductor size shall be not less than No. 16 AWG. Conductor insulation shall be type TFN for No. 16 AWG and type THHN/THWN for No. 14 AWG 1.6 millimeter diameter and larger.

Direct current auxiliary device control circuits shall be parallel wired per NFPA 72, Style Z. Positive conductor shall be colored red and the negative conductor shall be colored orange. Conductor size shall be not less than No. 16 AWG 1.25 millimeter diameter. Conductor insulation shall be type TFN for No. 18 or No. 16 AWG 1 or 1.25 millimeter diameter No. 18 or 16 AWG and type THHN/THWN for No. 14 AWG 1.6 millimeter diameter and larger.

Preaction solenoid valve control circuits shall be parallel wired per NFPA 72, Style Z. Positive conductor shall be colored yellow and the negative conductor shall be colored violet. Conductor size shall be not less than No. 16 AWG. Conductor insulation shall be type TFN for No. 16 AWG and type THHN/THWN for No. 14 AWG 1.6 millimeter diameter and larger.

3.2.6.1 60-Hertz Power

60-hertz power to the preaction control panel or separately powered devices shall be 120 volts. There shall be one black phase conductor, one white or grey solidly grounded neutral conductor and one green equipment grounding conductor. Conductor size shall be as shown on the drawing with the minimum size No. 12 AWG 2 millimeter diameter (No. 12 AWG) copper. Surge arrestors shall be installed in accordance with NFPA 72.

3.2.6.2 Installation in Cabinets and Boxes

Wiring in control cabinets and boxes shall be installed in a neat and orderly manner with wire properly grouped, tie-wrapped, or laced parallel and perpendicular to the major axis, supported and identified. Control wiring shall be continuous from device to device with no splices unless otherwise indicated. All wires entering or leaving control cabinets, boxes, and devices shall be permanently marked and terminated on screw terminals. Marking shall be consistent throughout the fire alarm system and shall be the same as the identification shown on the connection drawings.

3.2.7 Conduit and Raceways

Minimum size for preaction system initiating, notification, control and signaling line circuits conduit and raceways shall be 3/4-inch 12 millimeter. Installation shall be in accordance with NFPA 70.

Rigid galvanized heavywall steel conduit shall be installed in exterior above grade, interior exposed, from floor to five feet 1500 millimeter above finished floor unless otherwise shown on the drawings. EMT with hexnut expansion gland-type fittings may be installed in all other areas. Flexible metal conduit, maximum length six-feet 1820 millimeter, shall be used as the final connecting raceway to a preaction system device mounted

on vibrating equipment or on a suspended ceiling.

Conduit in interior finished areas shall be concealed. Conduit through fire-resistant rated walls, floors, ceilings, shall be fire-stopped in a manner that maintains the fire-resistant rating.

Conduit installed in a vertical position shall be parallel with walls and perpendicular with the floor and ceiling. Conduit installed in a horizontal position shall be parallel with the floor and ceiling and be parallel and perpendicular with the walls. Changes in direction of runs shall be made with symmetrical bends. Bends of over one inch 25 millimeter in diameter shall be factory made elbows.

3.3 FIELD TESTING

After complete installation of the equipment and at such time as directed by the Contracting Officer, tests shall be conducted to demonstrate that the installation requirements of this specification have been met and that the sequential functions of the system comply with the requirements specified herein. Tests covered in the following paragraphs shall be done in two parts:

1. Preliminary - This will be an "in house" test to verify all the systems and components. This functional test shall be performed in the presence of government inspectors and shall be repeated until the Contractor can perform one full test without device or system malfunction.

2. Final Acceptance - After the successful completion of the preliminary testing, the systems shall be fully tested formally with full documentation (including As-Built Drawings) using the previously approved recording form. Contracting Officer will witness this test and final acceptance of the system will be based upon his written approval of the test.

On both preliminary and final tests, the approved testing procedures shall be followed.

3.3.1 External System Wiring

The following tests shall be performed on the external system wiring before connection to the control panel:

Continuity of circuits shall be checked with an ohmmeter. Temporary jumpers shall be inserted in appropriate sockets of missing detectors and the end-of line resistor shall be installed when this test is performed. Resistance reading for each circuit shall be the value of the end-of-line resistor, plus or minus 10 percent.

Each wire shall be checked for grounds with a 500-volt insulation resistance test set. Resistance to ground shall not be less than 20 megohms.

3.3.2 Preaction System Acceptance Tests

After completion of the above tests, the external system wires shall be connected to the appropriate terminals in the control panel and the following tests shall be performed:

With the control panel energized, demonstrate the proper operation of all indicating lights and alarms.

Each circuit of the air sampling detection system shall be activated in accordance with the manufacturers instructions to demonstrate proper operations; both alarm and trouble.

Each time an initiating or supervisory circuit is activated, it shall be verified that the associated zone module, signaling-alarm circuits, auxiliary control circuits, and alarm reporting to the Central Fire Monitoring System is activated and the correct message is printed out on the Historical Reporting Terminal (HRT).

One lead at each alarm initiating device, shall be removed and grounded to demonstrate circuit trouble, ground fault, and then alarm over ground fault and an open circuit.

Power to each separately powered panel or device shall be turned off to simulate loss of power and to demonstrate operation of the trouble alarm.

Water suppression system valves requiring tamper switches, shall be opened and closed to demonstrate proper operation.

Water flow/pressure switches shall be activated by water flow at the inspectors test valve to demonstrate proper operation. Water flow time delay shall be set between 45 and 90 seconds.

Each alarm initiating circuit shall be demonstrated to operate its associated alarm-control and auxiliary control units and remote reporting.

One lead at each notification appliance and auxiliary device shall be removed and grounded to demonstrate open circuit trouble, ground fault trouble, and then operation over ground fault and an open circuit.

Each control unit shall be demonstrated to operate in all modes.

Capacity and the operation of the battery backup system shall be demonstrated to operate as required by these specifications by disconnecting the 120 volt, 60 Hz power from the preaction control panel and operating the system as specified for backup operation.

All circuits interconnecting with other systems fire suppression, fire smoke dampers, HV(AC), air sampling detection system(s)and facility fire alarm control panel, etc., shall be demonstrated to operate as specified on alarm from the associated zone or zones.

Multiplex equipment, devices, and wiring shall be tested in accordance

with NFPA 70 and manufacturer's requirements.

Test 10% percent of the existing facility fire alarm system devices in accordance with NFPA 72 to demonstrate proper operation of the existing facility fire alarm system upon completion of the software and hardware modifications.

3.3.3 Existing System Tests

Prior to any work, functionally test the existing fire alarm devices at the point of connection and those that are electrically on both sides of the point of connection.

Upon completion of the modification, functionally test the existing devices reinstalled and again test the devices that are on both sides of the point of connection.

After final acceptance testing has been successfully completed, the Contractor shall submit test data under the terms of the "shop drawing" clause of this contract.

-- End of Section --